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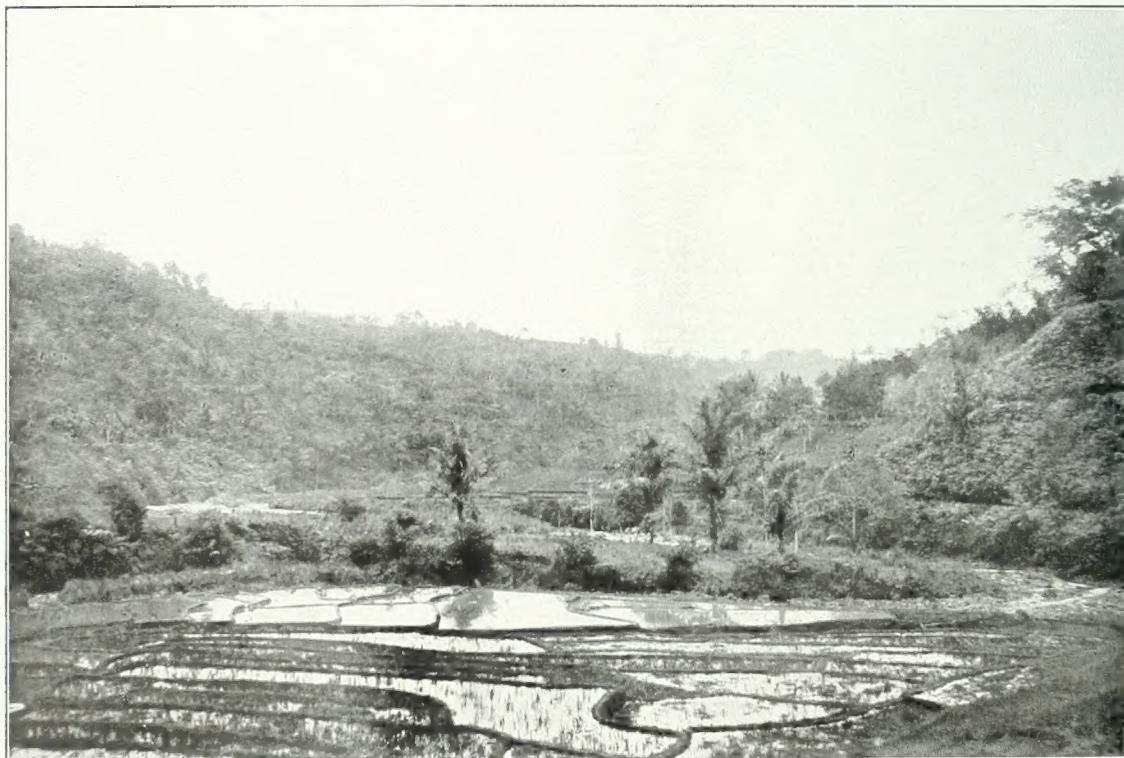


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THE GREAT CULTURES OF THE ISLE OF JAVA.



Tilling the sawahs (ricefields).



Inundating the sawahs before tilling.

THE GREAT CULTURES

OF THE ISLE OF JAVA

BY

F. FOKKENS,

RESIDENT OF MADURA.

30 PHOTOGRAPHS.

WITH A PREFACE BY PROF. DR. TREUB, DIRECTOR OF
THE AGRICULTURAL DEPARTMENT AND OF THE BOTANIC
GARDEN IN THE DUTCH EAST INDIES.



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Preface.

Being considered somewhat legendary and mysterious, the remote tropical colonies were very little known for a long time. Although reported sources of considerable riches, very vague notions of them, mostly far from correct, were generally known.

At the present day all this has much changed. The colonies and particularly those situated in the intertropical zone are at present every-where the subject of serious and thorough studies. Interest is taken in their history, organization and administration. Researches and investigations are being made in regard to their flora and fauna, as well as into the numerous problems which are present from an ethnologic and anthropologic point of view.

Large associations have been formed with the purpose of encouraging and directing these studies, and many a periodical, in several languages, is devoted exclusively to colonial questions.

In these questions the interest by preference relates to the political economy of the colonies and to their commercial importance. In this respect the mining resources are mentioned by some,

but it is principally to their agriculture that most of the attention is paid.

The heavy and frequent tropical rains, a temperature in point of fact the same during the whole year, a loose and fertile soil, the conditions very often experienced in the equatorial region, are essentially favorable to the development of agriculture.

Provided the latter is carried on in a not too irrational way, diversified and large crops are yielded, which the soil of the temperate countries can by no means produce.

Among those favoured countries, the Dutch East Indies hold a first place. Their insular climate is a warrant against the excesses of temperature and drought, and on the other hand, the generally volcanic nature of the rocks gives rise to an easy, and therefore rapid, disaggregation.

To these happy natural conditions, the isle of Java, especially, add another, not less important, to wit: the abundance of labourers.

With its thirty millions inhabitants, Java constitutes one of the most densely populated countries in the world. In fact, although still far from having attained to the pitch of agricultural perfection which it undoubtedly will do in time, the whole of its agricultural development surpasses already all that is seen in other tropical colonies.

It is for the purpose of giving an idea of this remarkable development that the author has made the present work.

A long administrative career has led him to the highest functions of the Government of the Interior. Better than anybody

else, Mr. Fokkens has been able to ascertain the preponderant economical importance appertaining to the agriculture of Java. His book speaks for it! The numerous data which he has taken the trouble to gather will contribute to make the most advanced and by far the most important of the Dutch possessions in the Far East still better known.

TREUB.

Rice.

§ 1. Rice¹⁾ is cultivated in two ways: I. after the so-called dry method; II. in fields which are almost constantly kept under water. As regards the production, the latter method affords the best results.

The first-named method is generally only applied in places where there is not enough spring-water and where sufficiently abundant rains cannot be relied upon.

The grounds where rice is cultivated after the last-named method, are called „sawahs” or rice-fields, i. e.: plots surrounded by small dikes between which water can be retained or stream away at discretion. Where the ground slopes, a succession of terraces is constructed, from which the water passes from one into the other.

Rice is cultivated at a height of 0 to 4000 feet on the most varied grounds, on vegetable-mould as well as on clay and sand-soil, in marshes and on a soil mixed with lime, and even on salt-grounds near the sea.

¹⁾ The plant which produces rice is called in Malay "padi".

§ 2. Generally the „sawahs” are tilled in the beginning of the rain-season after being inundated as much as possible; the small dikes are kept in good condition and care is taken to weed the wild grass in order to rid it of the vermin; then the water-ways are prepared. While tilling the grounds, the seed-plots are prepared; to this end a small surface (surrounded by small dikes enclosed by a hedge) that has been thoroughly tilled is inundated until it becomes a soft muddy mass, an operation which takes from 3 to 4 weeks; afterwards whole rice-ears are deposited in the mud or the grain is sown by hand. The latter method is the better and entails less expenses many grains being saved. However, it is not yet applied everywhere, because the population in many places, attached to the old customs, prefer the former method, viz: sowing whole ears.

§ 3. The seed-plot is alternately inundated and drained (first inundating during 8 to 10 days, then inundating by day and draining by night) until, after $1\frac{1}{2}$ to 2 months, (according to the kind and the disposition of the ground) the seed has grown to plants of from 1 to $1\frac{1}{4}$ feet high, after which they are transported into the „sawahs”, which generally takes place in the months of November, December or, at latest, in January. In places where, even in the fair season, sufficient springwater can be had, rice may be planted at any time of the year; the natives, however, pretend that rice reaped after the month of June



People on a rocky island.



Hillside in the Andes.

is usually subject to attacks of insects, diseases and other calamities.

In some regions seed-plots are not made, but the seed is immediately deposited in the „sawahs”; in that case it is necessary for the upper surface to be very level and everywhere equally muddy, otherwise many grains would be lost and would not germinate. Because this way of cultivating the plots involves much labour, it is but seldom adopted.

There are also regions where rice is sown in well tilled plots, but in a dry condition. Moreover, in certain regions, deprived of springwater, where the „sawahs” are only watered by rain, rice is cultivated as follows:

The seed is sown without repairing the dikes beforehand over their entire length. The water, if too abundant, can then escape; when, on the contrary, there is no rainfall or it is very slight, the dikes are repaired over a more or less considerable length and shut completely if there is a scarcity of water. If later on the rain should fall more abundantly, the dikes are partly destroyed to let the superfluous water escape.

§ 4. When the young plants have to be transported, they are plucked out of the seed-plots, then they are bound up in little bundles, the tops are cut, and they are conveyed to the „sawahs”. There they are laid — one, two or three at a time — in the muddy soil, the number depending on the size of the young plants, as much as

possible in rows, which are one to two decimetres apart.

For the rice-culture the „sawahs” are scarcely ever manured. It seems that the water of the rice-fields and conducts, which is kept on the „sawahs” for some time, is sufficiently fertilizing to maintain its production at the same rate.

After the planting the soil is drained during 2 or 3 days in order to allow the plants to recover; next it is inundated again and then the quantity of water is little by little diminished until the soil is drained completely, just before the gathering of shortly before the harvest; for the rest nothing but the removal of the wild grass two or three times is necessary — an operation which must take place before the florescence — afterwards the plantation has to be protected as much as possible against birds and wild boars, which are always on the watch about harvest time. The latter usually takes place at the end of the fourth or fifth month, according to the sort of rice, but in the higher regions a longer time is wanted, sometimes 6 or 7 months.

§ 5. For the so-called „dry” cultivation method, the planting is done in two ways, viz: tilling the dry soil by means of the plough or by the „patjol” (a kind of spade) leaving no clods, the surface being made very even in order to sow the grain afterwards, or, the soil is not worked at all and is only cleaned, after which holes are made, 2 decimetres apart, for the reception of some grains. This method



Cropping the padi.



Bundling and stacking the padi.

is only adopted on original ground and only „*Oriza montana*” and not „*Oriza sativa*” is used in this case.

§ 6. Rice is highly susceptible to diseases and has much to suffer from vermin. Sometimes the plant seems sound and fresh, whilst the ears remain empty.

During heavy rains, when the water cannot run away, a kind of caterpillar makes its way through the stalk and kills the plant.

An insect, the „*walang sangit*” (*Leptocoris acuta*) abstracts the sap from the newly-budded ear and so prevents the fruit from forming. In a short time the whole crop is entirely destroyed in this way.

Of late years a disease has been made a subject of study, which the natives call: *měntek*, *měnděk*, *dědět*, *omo merah*, etc. The parasite, which causes this disease, is a nematode, known under the name of „*Tyleachus Oryzea*”; it attacks the root. The more or less bad quality of the soil has a great influence on the development of this disease.

Mice are not less destructive for in a single night they can destroy a whole rice-field.

§ 7. The off-shoots are not lopped by means of a scythe, but one by one cut with a small crooked knife, that is held between the fingers. Knife and offshoot are held in the same hand and then the latter is cut; with the other hand, the ears are gathered, The cut-off rice is made into bundles in the field and then stacked. If the weather is favourable, it is dried in the field.

In order to remove the grain from the stalk, the rice is put into a kind of trough in which it is beaten with a pestle.

To remove the husk from the grain, these troughs are also used; moreover mills of very simple construction: a trough in which disks of wood, iron or stone, are propelled by buffalos or by water. There are but very few mills in Java after the model used in Europe.

§ 8. After the rice-crop — if the soil be light enough — the „sawahs” are used for the cultivation of different kinds of vegetables which do not require more than 2 or 3 months to fructify, such as: batates, viqua sinensis, Soya Hispida, Capsicum, Solanum, Cucumis, Arachis, Voandzeia subterrana, &c. — In the Preanger, in Bantam and in some other regions, where there is sufficient springwater during the wole year, the „sawahs” are also used for cultivating a kind of fish, which requires only 2 to 3 months to be fit for food.

§ 9. The production amounts on an average to 25 or 30 picols ($62\frac{1}{2}$ K^{os}) dry „padi” per baoe of 1500 square metres ($1\frac{1}{2}$ H.A.), yielding, after being husked, 15 picols rice. The total production of the isle of Java was in

1895	36.702.450
1896	33.354.200
1897	35.194.600
1898	35.935.550
1899	37.500.000

1900	39.887.200
1901	35.481.150
1902	36.962.300
1903	37.057.140
1904	38.257.090
1905	37.288.080
1906	39.442.662
1907	38.864.812

Coffee.

§ 1. Kind of soil.

The coffee-tree flourishes in the isle of Java at any height under 4000 feet, although the elevation, best suitable for it, varies between 1500 to 3000 feet. This regards the ordinary Java coffee-tree, the Liberia coffee-tree, on the contrary, grows best in level grounds.

Too heavy clay-grounds are not at all suited for the coffee-culture, neither is sandy soil generally; however, very fine plantations are found on the sand-grounds of the Kloet. Mixed grounds, not too firm, of a dark colour and full of vegetable-mould are the best. Stony ground must not always be rejected and certainly not when the stones are so mixed with the ground as to form a natural drainage, which generally assures good vegetation.

§ 2. Reclaiming and improving the grounds.

The reclaiming of the grounds takes place in the beginning of the dry season and is done in several ways.

In places where there are forests, these are completely cleared, avoiding, however, the destruction the wood by fire so as to prevent burning the vegetable-mould at the same time. Some people burn the wood as much as possible and mix the ash with the soil; others again — although rarely — leave part of the forest, pull down the rest, clean the ground and then set the plants, so securing them a little shade.

Those who destroy the forest entirely do not neglect to leave some rows of trees on the windward side, in order to protect the young trees.

The level grounds are cleared of all sorts of wild grass, and sometimes they are then tilled by means of the „patjol”, seldom with the plough.

On the slopes, clearing is only done by the hand or by means of the „arit” (a kind of bent knife), as the patjol makes the mould too loose, so that, in the time of heavy rains, it would be washed down to the plains. To prevent the latter inconvenience terraces are formed; these can be tilled with the patjol without harm.

In no lands whatever is „alang-alang” (a kind of long grass) allowed to remain; this injurious weed must be uprooted, dried and destroyed by fire.

Generally, in Java, holes are made before putting the plants into the ground. To this end, in the cleaned ground holes are made of 2 feet diameter and 2 feet depth, which are left open to the air for two months, after which period

they are filled with good soil, or soil mixed with manure. It is however scarcely ever possible to obtain manure in sufficient quantity. Besides in fallow grounds this would mean a superfluous expense.

The young plant, thus placed in good ground, grows rapidly and soon bears fruit, but as soon as the root touches the harder and less fertile soil at the bottom and at the sides of the hole, the tree commences to languish and often dies shortly afterwards. To avoid this evil the hole is enlarged by means of the patjol before filling.

When the grounds are prepared in the above-mentioned way, paths are traced in them and, in the plains ditches are made for draining purpose; next, trees are planted to obtain the shade required, whenever the trees which have been left intact are not sufficient.

§ 3. Trees for giving shade.

The „dadap” (*hypophorus subumbrans*) and the „*Albizzia molucana*” are commonly used in order to ensure shade.

Of late very successful experiments have been made with the „*Pithe colobium saman*”. This tree, being of a very vigorous growth and affording dense shade the trimming thereof is very expensive, consequently the tree is rarely used. For some years past the „*Déguelia microphylla*” has been used; it soon shoots, does not become too tall and does not give too much shade. The

„dadap” however is to be preferred above all other sheltering-trees; unfortunately during the last twelve years the tree is subject to all kinds of diseases, so that it had necessarily to be replaced by another kind.

The more elevated the ground, the less shade it requires, so that, consequently, the distance between the trees varies according to the elevation. In plantations under 3000 feet high, the „dadap” is planted at a distance of 12 by 12 feet (1 feet = 3 decimetres), at an elevation of upwards of 3000 feet it is planted at a distance of 18 by 12 feet; provided the coffee be planted at a distance of 6 by 6 feet; in case this distance is 6 by 8 feet, the distance of the „dadap” must be respectively 12 by 16 and 18 by 16 feet, and when the coffee is planted at a distance of 10 by 10 the „dadap” must be respectively 12 by 20 and 18 by 20 feet apart.¹⁾ The „*Albizzia molucana*” should not be planted less than from 24 by 30 feet in grounds respectively under and above 3000 feet.

Although the „dadap” is inferior to the „*Albizzia*”, with respect to the shade produced, the former tree is preferred, however, because it has not, like the „*Albizzia*”, the drawback of being very frail and often losing branches, which in their fall break the coffeetrees down.

To plant the dadap, young off-shoots of $2\frac{1}{2}$ feet in

¹⁾ The distance between the sheltering-trees depend not only on the elevation, but also on the climate. In a rainy climate the plants are not set so thickly as in a dry climate.



Seed plots for pine testing



The garden at Luttrell's

length are used, which, at a slight incline, are put into the ground. The „Albizzia”, on the contrary, is sown. The seed is left in luke-warm water for one night and then sown in seed-plots. The sheltering-trees are planted at the same time or some months before the young coffee-trees, as the latter want light and a certain quantity of sunshine during the first year. If there is too much shade, the young coffee-tree grows to too great a height.

§ 4. The planting of the coffee-tree.

The coffee-tree is sown. The ripe berry, after having been freed from its husk and washed with water mixed with ash, to take off the slimy substance surrounding the grain, leaves a bean composed of two parts (the so-called masculine coffee-bean forms one whole) in a husk. These parts are sown separately. In the beginning of the year, from January to April, according to the height in question (in high grounds earlier), the grains, so prepared, are planted a little under the surface, at a distance of 15 cm. apart, in well (artificially) shaded seed-plots.

Twice as many grains are sown as the number of trees required, because the grains do not all thrive equally well and also to reserve plants for replacing the dead ones.

As the plant develops the cover of the seed-plots is partly removed, and this is done entirely, as soon as the plant has reached a height of $\frac{3}{4}$ feet (20 to 25 cM.)

Care should be taken that the young plants are always watered, the ground cleared of the wild grass and loosened from time to time.

In the beginning of the rain-season, in the month of December, the plants are transferred from the seed-plot to the plantations, the roots covered with a layer of earth. Many people neglect this last precaution and transport the plants in bundles.

In the plantation grown-up plants are not always used; oftentimes young off-shoots which have grown up from fallen grains, are taken from under the old trees.

§ 5. Transport of the young plants.

On the spot, destined for the plant, a hole is made by means of a stick, or also a „patjol”; the plant is put in it, care being taken not to bend the root; then the hole is filled and the soil around stamped. The distance between the plants must be from 6 to 8 feet for trees of say 10 years old; from 8 to 8 feet for trees of from 11 to 15 years, and of from 6 to 10 feet for trees of more than 15 years of age.

§ 6. Maintenance of the Plantation.

When the plants are in the soil, the plantation should be cared for, i.e.: it must be kept clean. The grass which is not harmful, can be left, but that which multiplies at the roots must be plucked out and then

and the corresponding values of the parameters.

The first set of parameters is obtained by fitting the model to the data of the first 1000 observations.

The second set of parameters is obtained by fitting the model to the data of the last 1000 observations.

The third set of parameters is obtained by fitting the model to the data of the first 500 observations.

The fourth set of parameters is obtained by fitting the model to the data of the last 500 observations.

Finally, the last set of parameters is obtained by fitting the model to the entire dataset.

The results of the parameter estimation are shown in Table 1. The estimated values of the parameters are as follows:

Estimated value of α : 0.1
Estimated value of β : 0.05
Estimated value of γ : 0.01
Estimated value of δ : 0.001

Estimated value of ϵ : 0.0001
Estimated value of ζ : 0.00001
Estimated value of η : 0.000001
Estimated value of θ : 0.0000001

Estimated value of φ : 0.0000001
Estimated value of ψ : 0.00000001
Estimated value of ω : 0.000000001

Estimated value of ρ : 0.000000001
Estimated value of σ : 0.0000000001
Estimated value of τ : 0.00000000001

Estimated value of λ : 0.00000000001
Estimated value of μ : 0.000000000001
Estimated value of ν : 0.0000000000001

Estimated value of ξ : 0.0000000000001
Estimated value of ϕ : 0.00000000000001
Estimated value of ψ : 0.000000000000001

Estimated value of χ : 0.000000000000001
Estimated value of ψ : 0.0000000000000001
Estimated value of ω : 0.00000000000000001

Estimated value of ρ : 0.0000000000000001
Estimated value of σ : 0.00000000000000001
Estimated value of τ : 0.000000000000000001

Estimated value of λ : 0.00000000000000001
Estimated value of μ : 0.000000000000000001
Estimated value of ν : 0.0000000000000000001

Estimated value of ξ : 0.0000000000000000001
Estimated value of ϕ : 0.00000000000000000001
Estimated value of ψ : 0.000000000000000000001

Estimated value of χ : 0.0000000000000000000001
Estimated value of ψ : 0.00000000000000000000001
Estimated value of ω : 0.000000000000000000000001

lose many leaves and off-shoots through the disease. It is also very difficult to remove continually the young off-shoots, which unceasingly shoot out at the foot of the trees if the tops are lopped. Nevertheless, here and there this method is still followed.

Manure is only used in barren grounds and then most often around languishing trees. Stable-manure or dry leaves are placed with care so as not to touch the roots. A trench of a foot deep is dug, the manure is put in and covered with soil.

§ 7. The crop and the preparation.

At the end of 2 to 3 years already the tree commences to bear fruit. However, only after 5 to 6 years are abundant crops gathered, which on an average continue until the 15th year. Plantations of 40 years old and more are found, but this is an exception. The coffee-tree blossoms in the beginning of the rain-season; the crop-gathering takes place about six or seven months after the blossoming.

The fruit is prepared in the ordinary way or in that known as „the West Indian way”. The latter method is at present mostly adopted, because the coffee prepared in this way is most sought on the European markets.

The first method consists of letting the fruit dry in the sun and taking off the covering by beating them with a pestle, or by letting them pass between wooden or iron disks. After this the coffee is cleared by means of a fan

and sorted, either by the hand or by means of a cylinder provided of wire gauze with meshes of different sizes.

The method, known as the West Indian, consists of husking the fruit directly after harvest. To this end, cylinders are used propelled by steam or water. Next the grain, thus discharged from the pulp, is washed in order to remove the slimy matter, and is then dried in a drying apparatus or thrashed and fanned to remove the last husk.

The ordinary Java-coffee can be prepared in both ways. The latter makes the bean shiny and ensures higher prices on the European markets. For the Liberia-coffee the last-named method is the only good one; without this the coffee would have a bitter and disagreeable taste.

§ 8. Sorts of Coffee.

Several sorts of coffee are cultivated in the isle of Java, such as: ordinary Java, Liberia, Mocca, Margogype and for 3 or 4 years past Robusta. The last 3 sorts are only found in some small plantations: ordinary Java-coffee is best represented. However, of late years, Liberia is planted more and more as it is stronger and can resist disease better than the ordinary Java which has been so popular here for a long time.

It has been tried to graft the Java-coffee on the „Liberia”, up till now however there is but one plantation where this operation is carried out on a large scale.

The so-called „masculine” coffee is not a special sort, but a casualty, the fruit containing only one grain instead of two.

S. 9. The disease of the coffee-tree.

It is a known fact that for 17 years past, the coffee-culture has much to suffer from a disease, called the „*He-mileia vastatrix*”, a mildew which attacks first the leaves.

This mildew is to be recognized by an orange-coloured matter that appears itself at the back side of the leaves and can be removed by the hand. When the disease continues, the attacked leaf falls, the branches and the fruit grow black and the fruit decays. Large plantations have hereby been completely destroyed in a few months; no disease has ever caused such disaster to the culture.

Numerous efforts have been made to prevent the disease.

First it was believed that it was better to make the soil loose and manure it more. The trees grew stronger and could better resist the disease, but the evil continued to propagate.

Then antiseptic remedies were applied to combat it and preservatives to prevent the disease. Trials have been made on a large scale in watering the plants with an infusion of tobacco or with Bouillon Bordelaise. The attacked parts of the young leaves have been pricked with sulphuric acid, or the plantations have been protected on the wind-side by growing hedges to prevent the germs in the air,

from penetrating into the plantations. For a long time it was believed that the best results were obtained by watering the seed-plots and the young plants with an infusion of tobacco and by the growing hedges around the plantations in the plains (on slopes it is difficult to protect the plants by hedges), but this method has been abandoned and strongly manuring the coffee-trees has been tried.

However, none of those remedies has been of much avail; the disease continues to destroy plantations and many a planter has been ruined, especially those who have their plantations in poorer grounds and in the plains. Trees in the mountains, and planted in plots full of vegetable-mould, resist the disease, and if they are attacked, they do not suffer so much.

Coffee-trees have also much to endure from a louse which causes leaves and branches to turn black, this being the origin of the name of „black rust” given to this disease.

A disease caused by microscopic insects which attack the roots of the coffee-trees, and in a short time do considerable damage is called the „Aaltjesziekte.” The „konuk” and the „Ooret”, a kind of scaraboes that attacks the roots of the coffee-trees, is another insect, called the „koffieborer”, which destroys the trunk.

§ 10. *Productions.*

The coffee-culture in the isle of Java is practised

both by Government and by private persons; the former is a forced, the latter a free culture.

The Government-culture yielded during the last dozen years, as follows:

The private culture:

in 1895	319839	picols	378801	picols
„ 1896	263739	„	451735	„
„ 1897	474368	„	540403	„
„ 1898	91731	„	227710	„
„ 1899	198708	„	552040	„
„ 1900	222110	„	414384	„
„ 1901	134315	„	253305	„
„ 1902	238347	„	517395	„
„ 1903	305071	„	460469	„
„ 1904	87343	„	284817	„
„ 1905	87415	„	362671	„
„ 1906	168343	„	318185	„
„ 1907	30702	„	195116	„

Sugar.

§ 1. In the isle of Java different sorts of sugar-cane are cultivated, especially one, known as the black Cheribon-cane which is of a red or brown colour. The natives, however, cultivate preferentially a kind of white cane for the interior market because it develops more amply. At one time the white cane was also used by manufacturers, because it was believed that it was less subject to the prevailing disease, viz.: the „sereh”, which proved, nevertheless, to be an error.

With a view to this disease several sorts of sugar-cane have been tried, such as the Madagascar, the Mauritia, the Sandwich, Borneo and New-Zealand, but none of them could resist it. The Fidji-cane is very hardy, but it contains but little sugar and therefore is rarely cultivated.

§ 2. In Java the sugar-cane is cultivated according to two methods, called the „broedjoelan” and the „Reynoso” system. For the first-named method the soil is completely tilled and trenches are dug at an equal distance of from three feet (1 ft. = 31 cM.); in these trenches at a distance

of one or two feet apart oblong holes are made, in which after some time the pieces of sugar-cane are deposited. For the second method the soil is not tilled, but trenches of 16 by 25 ft. in width and 12 ft. in depth are dug at from 3 to 5 ft. apart. The soil is thrown between the trenches, then holes, as mentioned above, are made.

§ 3. For the shoots, both systems use the tops of the cane, cut at a length of 1 feet, after having taken off the green extremities. They are held for some time in streaming water and then are placed horizontally or slightly inclined in the holes. Sometimes the shoots are also first placed in seed-plots.

Because of the disease, called „sereh”, some people dissuaded the constant use of the upper, and therefore the younger part, of the cane for shoots. They thought that hereby the plant was weakened and rendered more liable to the disease and they advised the use of a stronger part. This advice has been conformed to, but without result.

Afterwards they went farther still; instead of taking cane-shoots, cane seed has been sown. Doctor Saltwedel was successful in this process with the yellow cane, imported from Hawai. This method has yielded good results. At present several kinds of cane are cultivated with success by the seed-sowing method.

§ 4. In Java the sugar-cane is cultivated in „sawahs” (rice-fields) and on grounds serving for dryer cultures such as rice (this very seldom occurs). Clay-, as well as sandy-soil



Plantation of *S. gracilis*.



Shrubland of *S. gracilis*.

are made use of to a height of 2000 feet. In the irrigation and drainage great care must be taken. As a rule, the ground is tilled about the months of March and April and planting is commenced in the month of July. This month falling in the middle of the dry-season the young plants are watered. Before and after the planting, the soil is manured with ammoniac sulphate and carvi cakes. The cane ripens within ten to fourteen months in the plains; in higher grounds it takes not less than 18 months. The crop is gathered from June till October.

§ 5. When the cane is ripe, it must be cut as soon as possible, as otherwise the sap diminishes in quantity and also diminishes in quality. It is cut off level with the ground or plucked out by the roots. In the fields the leaves are taken off and the tops are cut to serve for the new planting.

§ 6. After the crop the cane is transported to the mill to be crushed. The wood, dry leaves and ground cane are used as fuel. The average production of cane of one baoe (0,709649 Hectare) amounts to 900 picols (= 56000 K^{os}); sometimes double this quantity is reached.

As soon as the cane has been cut and transported to the mill, it is pressed between cylinders, two of which are placed horizontally and another above them. By this simple operation about 65 to 70 per cent of the weight of the cane is reduced to sap. Much sugar is still left in the remainders (called the „ampas“) and, for this reason

manufacturers endeavour to extract still more from it by submitting the cane to a double, triple and even quadruple pressure with imbibition of warm water, with the result that they obtain as high a percentage as 80 per cent. With the same purpose, in some mills the diffusion-method was applied by which up to 90 % of sap was extracted. This method did not consist of pressing the cane, but in cutting it in slices, which were then washed. This method is no longer applied.

The sap obtained by pressure subsequent to its transfer from the press to the weighing tanks, is filtered and purified. The purification in many mills is obtained by warming the sap, after mixing it with lime, boiling it in pans, while taking off the scum, and by precipitating it. Then the sap is submitted to a pressure in filter-presses, until only dry cakes are left, which, however, still contain much sugar.

There is another method which is more expensive, but on the other hand better. It is the saturation- or carbonisation-method. The sap is saturated with lime and is then precipitated with carbonic acid, after which operation it is pressed in filters.

The purified sap is then transferred to an engine of triple or four-fold power, where it is evaporated under a gradually decreasing atmospheric pressure and condensed to 30° Beaumé. This sap undergoes another purification in elimination-pans or in filters and is then boiled in the



Transporting rice sacks to the mill



Interior view of the mill

vacuum. The sugar thus obtained — after having been cooled — is then put into centrifugal machines to eliminate the molasses. In order to remove the last trace and so to get very white sugar, the product is finally exposed to a fine spray of water or steam.

The sugar, on leaving these machines, is dried in the sun or artificially and then packed in „krandjangs” (kind of basket) of about 2 picols.

The molasses obtained by the centrifugal machine still contain sugar. Therefore, they are once more boiled in the vacuum to pass for the second time through the centrifugal machine after having been cooled. However, even then they still contain sugar, but it is very difficult to extract it. For this reason, the manufacturers let the molasses run into the rivers or distil, like the Tjomal-mill, alcohol (arrack) from them.

As said above, dry leaves or the „ampas” which leaves the mills is used as fuel for the machines; sometimes also wood (seldom coal). In the ovens, specially constructed for this purpose, the wet ampas is used, but mostly it is dried in advance in the sun.

§ 7. The sugar-manufacturers in Java have two experimental stations where trials are continually made upon the culture and production of sugar by specialists and learned men in the sphere of tropical agriculture.

§ 8. On an average 115 picols of sugar are produced

per baoe (0,709649 Ha); there are mills which yield 160 picols.

The total sugar production in the isle of Java was:

in 1895:	9454441	(195 fabrics)
" 1896	8697000	(190 ")
" 1897	9471249	(191 ")
" 1898	11175280	(178 ")
" 1899	12301689	(175 ")
" 1900	12031987	(186 ")
" 1901	13091388	(185 ")
" 1902	14435138	(188 ")
" 1903	14921096	(183 ")
" 1904	17037313	(184 ")
" 1905	16834180	(183 ")
" 1906	16041195	(176 ")
" 1907	18138304	(177 ")



Seed-plots for the Peruvian bark.



Preparing the grounds for planting the Peruvian bark.

Peruvian bark.

§ 1. The sorts of Peruvian bark mostly planted in the isle of Java are the Ledgeriana, the Officinales, and the Succirubra; especially the Ledgeriana, because of its great intrinsic value. This value is inferior in other sorts, which are however greatly appreciated for their pharmaceutic bark. The demand for this bark being limited and the planters fearing to keep an article without value in case of overproduction, these trees are only planted in small numbers. The same is true of the Officinales, as it grows slowly and best in high regions, which are avoided, however, being less appropriate for the Ledgeriana.

§ 2. The favourite sort is consequently the Ledgeriana. However, as this tree does not grow so quickly as the Succirubra, because of its being more susceptible to disease, many planters have been endeavouring of late years to graft the Ledgeriana on the Succirubra and with success, for experience has proved that the trunk below the graft effects but very little the value of the Ledgeriana.

The grafting is done in the open air, generally after

The sticking method is similar to that applied in France to some plants like the Azaleas. The wax is made by mixing 8 parts of resin with 2 parts of fat, which are melted and then poured into cold water.

§ 3. Many other planters however, still follow the old method of culturing by sowing. This is done in beds which are then entirely covered. In 20 days to a month the grains begin to shoot.

If moss or mould find their way among the plants and prevent their growth, the little sheets are removed and re-planted in similar beds, but at equal distances of 5 cm., and this operation is repeated as soon as the plants have reached a height of from 10 to 15 centimetres; the distance is then 15 cm.

If moss or mould do not hamper the growth and sowing has not been done too densely, the original planting may be left to grow. The second planting is often done under ferns, which have been placed in the soil between the young plants so as to shade them. When the young plants are sufficiently developed the shade is superfluous. Plants of more than half a foot high hardly need this shade.

§ 4. Nine or thirteen months after the grains have been sown, plants of 1 foot high, are obtained which can be transplanted to the prepared grounds, where they are planted, the Succirubra in 5 and the Ledgeriana in 4 square feet of ground each; it is better, however, to wait until the plants have reached a height of 1 metre.



Seed-plots for the Peruvian bark



operation. When 4 years old a small crop is already obtained by lopping the trees. The lopping of the trees is regularly continued until the tree has attained to maturity and is fit to be cut down.

The crop is gathered in four different ways, viz.:

1. The whole tree is dug out;
2. It is chopped off at the root;
3. The bark is cut in bands and the tree is wrapped up in moss, that the bark may recover;
4. The bark is scraped off by means of a small plane up to the cambium. Generally, only half of the bark is taken off and the other half is not touched till the first is sufficiently restored. The bark is peeled off with knives of bamboo or horn. Iron knives wound the bark or discolour it.

In Java all four ways have been tried, but gradually the greater part of the planters have broken with the methods mentioned under 2, 3 and 4 above, and keep exclusively to the first mentioned, i. e. digging out the whole tree.

§ 8. The gathered bark is dried in the sun, on drying-apparatus or over the fire on iron-plates. On one side of the plates, which rest on little walls, there is the oven and at the other side the chimney so as to permit the fire and smoke to pass under the plates. More expensive drying-apparatus is the Jackson's siroccos in which the fire itself causes the air-circulation.



PALAU INDIAN ST. 0-2





Chopping the Poles in Field



Ancient Village of the Lahu People

§ 9. The sorting and packing of the Peruvian bark must be carefully carried out.

In commerce the Peruvian barks are distinguished in two principal classes, viz. I. those destined for manufacturing sulfate of quinine, and 2. those for the use of pharmacy for extracts, colours, wines, &c. In sorting the barks for the manufacturing of sulfate of quinine care must be paid to have barks of an equally intrinsic value of quinine; while in the sorting for the use of pharmacy a good appearance should especially be considered.

§ 10. The production of Peruvian bark in the isle of Java was in:

1895	3950667	K ^{os}
1896	3826085	"
1897	3403102	"
1898	4513815	"
1899	5092608	"
1900	5668795	"
1901	6316090	K ^{os}
1902	6433421	"
1903	7122589	"
1904	8652954	"
1905	8052648	"
1906	5972550	"
1907	8985816	"



Drawing apparatus for Persian film.



Tobacco.

§ 1. Tobacco flourishes from the sea-shore to a height of 6000 Metres up the mountains; nevertheless, the lower regions must be preferred, as the manufacturing can be done with less trouble on account of great dampness or heavy winds.

The crops from the higher grounds dry but slowly and sometimes only on the outside, so that the product gets mouldy and often becomes quite valueless.

Soil composed of a mixture of clay with sand (especially when it contains vegetable-mould) is most adapted to the tobacco-culture; the situation and the climate are also of great importance. It must be possible to drain the plots and the plants must from time to time be watered by rain.

§ 2. To obtain good tobacco, it is necessary to use good seed. This is taken from the best developed plants, and only those grains the development of which can be relied upon are plucked.

Towards the time that the tobacco-plants are topped, the planter selects on his field those parts where the plants are best developed and are likely to produce good seed.

These parts are then surrounded by hedges and are very carefully tended until the tiny fruit is ripe. When the ripe fruit has been plucked, they are dried in the sun; the husks burst and the grains fall. They are preserved in hermetically closed bottles.

§ 3. Formerly sorts of tobacco, originally from Java, were planted. The leaves were too small and not broad enough, they were not in demand in Europe, so that other sorts were used. At first Dutch tobacco was taken, it grew very well, but soon degenerated. Then Havanna-and Manilla-tobacco were tried. The trials with Havanna-tobacco did not answer. The quality changed entirely and consequently became unfit for commercial use. Trials made with Manilla-tobacco had a better result. This sort also degenerated, but this was the very cause of its yielding qualities which made it „par excellence” fit for treatment. It lost its taste and perfume, but preserved its original flexibility, so that it could be used for treating all kinds of tobacco.

Plants of Deli-tobacco have also been tried with good results.

§ 4. The grains are directly sown in the plots, mixed with wood-ash. Also, but more rarely, the grains



Plantation of tobacco



Process of making tobacco

before being sown, are germinated on moistened sheets, which became necessary to protect the grains in the plots from injury caused by ants.

When the grains have germinated, which is to be seen by their changing of colour, they are removed from the sheets, mixed with ash and then sown on the plots.

The seed-plots are similar to those used for the cultivation of coffee, only instead of fixed coverings, they are adjustable to permit the regulating of the light.

Much care must be taken of the grains in the plots. At first they should be watered at least twice a day; the sun is only allowed to penetrate in the morning. After some time one watering suffices, and only the afternoon-sun should be avoided.

§ 5. When the plants are about 40 or 50 days old, they may be transplanted in the prepared grounds. It is necessary also to protect them during the early days against the sun, which is done by covering each plant with a bent leaf fixed in the soil, or the plants are covered with a little rice-straw. At the very first they also need to be watered.

After two weeks the covering is taken away and the ground around the plants made loose. Later on this process is repeated by means of the patjol (a kind of spade).

Generally the plants are set at a distance of from

1 $\frac{1}{2}$ to 3 feet. As soon as the plants have reached a height of one foot, the lower leaves are taken off and the trunks covered with clods. The latter manipulation is repeated once or twice. When the plants have nearly reached their complete development, they are topped in order to prevent the blossoming and to accelerate hereby the development of the leaves.

This topping demands much care. If too many leaves are removed, the remaining ones become thick and heavy; if, on the other hand, not enough are lopped, the leaves remain small.

After the topping the tobacco is left to develop for two weeks more until complete maturity, so that it may benefit, if possible, from some showers which take away a kind of fat from the leaves, increasing hereby their inflammability.

§ 6. Within 65 to 90 days the tobacco is ripe, which is evident from the fact that the leaves begin to droop. The leaves are then plucked one by one, strung and then hung up in the drying-shed, or the plant is cut off a little above the ground and in that way many leaves are hung up at a time, the lower leaves have the greatest value, these are always plucked first one by one.

In the drying-sheds, which are constructed of wood and bamboo and covered with straw, and which as a rule are 100' to 400' long and 30' to 60' wide, the tobacco is strung on laths of bamboo and kept from the light. The

tobacco remains in this condition for 30 to 40 days. Then the leaves are taken off the laths and are sorted according to their length, their colour and their fineness: next, they are bound in bundles of 40 to 50 leaves, which are transported to the fermentation-shed. In these sheds, most of which are constructed of stone and covered with zinc, the tobacco undergoes the last manipulation consisting of fermenting, selection and pressing of the bales.

The fermentation is done by putting the tobacco in piles on a wooden floor. In the beginning the fermentation-process is very quick, and therefore the piles are very small and contain only from 5 to 10 lbs. of tobacco. After a few days the piles are made loose and increased until by the end of the fermentation time they contain 60 or 80 thousand lbs. In making the piles, perforated cases of bamboo are laid in them to hold thermometers, so that at any moment the increase of temperature inside the piles may be ascertained and thus the piles can be made loose at the proper time. And this is very necessary, as the temperature of tobacco may increase in a single day to such a pitch as to cause fire.

If the temperature remains the same as that of outside the fermentation is finished. The tobacco is taken off the piles and is once more sorted.

When the tobacco has been pressed to bales of 150 to 200 lbs. and sewn into mats, it is ready for shipment.

§ 7. The production of tobacco destined for Europe
in the isle of Java was

1895	9807222	kilogr.
1896	13286012	"
1897	16354371	"
1898	18618375	"
1899	24329570	"
1900	22277198	"
1901	12372592	"
1902	26289534	"
1903	26886370	"
1904	30407491	"
1905	29934558	"
1906	29238596	"
1907	37892449	"

T e a.

§ 1. The tea-plant is a shrub cultivated in the isle of Java at a height of from 500 to 3000 feet, in different soils, generally clay-grounds mixed with vegetable-mould and drained as much as possible.

§ 2. Tea is propagated by seed which must be fresh, to ensure its prompt growth. The seed is ripe when the seed-coat bursts and drops the grains which have a dark-brown colour and are picked up from the ground.

Each husk contains 1 to 3 grains. It is estimated that of a quantity of fresh seed $\frac{2}{3}$ take, whilst, when using seed of one or two months old, this will be the case with only $\frac{1}{4}$ to $\frac{1}{10}$.

§ 3. The culture of grains is done on beds or the grains are carried to the plot and sown at a depth of from 3 to 5 centimetres in the soil, which has been thoroughly tilled beforehand, or they are laid in furrows of 9 cM. width and 12 cM. depth. These furrows have all

been open for a month already and are filled again a short time before the sowing.

At every place where a tea-plant is desired, 2 or 3 grains are deposited at a distance of 2 to 3 feet from each other, not too densely, so that, if more than one grain should grow, there is a possibility of removing the superfluous plants without doing harm to the rest. Some planters first germinate the grains by spreading them over a shady spot and covering them with vegetable-mould. When the grains commence swelling and bursting, it is sufficient to plant one grain instead of three.

Sowing in beds is preferred, which is especially necessary to obtain plants for filling in purposes, the grains are set at distances of from 10 to 20 cM. after having been laid in water for 24 hours. Those which float are bad, those which sink to the bottom are good. From time to time the grains require to be watered, as well as to be shaded in the outset, if a good development should be wished for.

§ 4. After the planting, care must be taken that the plant develops regularly, this ensures a regular crop.

With this aim the languishing and dying plants should be replaced at once.

Two or three times a year each garden must be turned over, and once every month weeded in all parts, while the soil round the plants must be kept light.

In the second or third year furrows are often dug



Assam tea-plantation



Hilly state

between the plants of 3 to 12 feet long, 1 foot wide and 1½ foot deep to ensure them more light.

Manure also is used, mostly oxen-manure mixed with vegetable substances.

§ 5. As regards diseases, the tea-plant suffers mostly from rust caused by an insect called „Heliopeltis theivora” the same insect that attacks the Peruvian bark.

All kinds of measures have been adopted to stamp out this disease, but in vain. The most effective measure is killing the insects, lopping the shrubs and embedding the whole cut-off mass, so as to annihilate the eggs which the insect lays in the as yet tender and green shoots. The surviving insects, finding no young leaves left, are condemned to death by want of food.

§ 6. Tea-plants can be harvested in their third or fourth year. The first harvest is but insignificant, and is followed by a light lopping; afterwards the production of leaves steadily increases. If the tea-shrubs have been planted well and thorough care has been taken of them, the harvest may continue, so to say, *ad infinitum*. The two leaves at the extremity of the tree yield the finest tea, viz: the „pecco”, both the green tea as well as the black; the following leaf produces the „souchon” and the other leaves the „conggo”.

From time to time the shrubs must be forced to form shoots and prevented from blossoming and so producing seed. This is effected by a more or less thorough

lopping, not more than once a year. In plantations on higher grounds it is often sufficient to lop the shrubs once every two or three years. The best moment for lopping is at the end of the dry season. Forty days after the lopping the plucking of the young leaves may be continued again.

A productive garden yields from 1000 to 1200 lbs. per baoe (7096,5 square metres) and per annum.

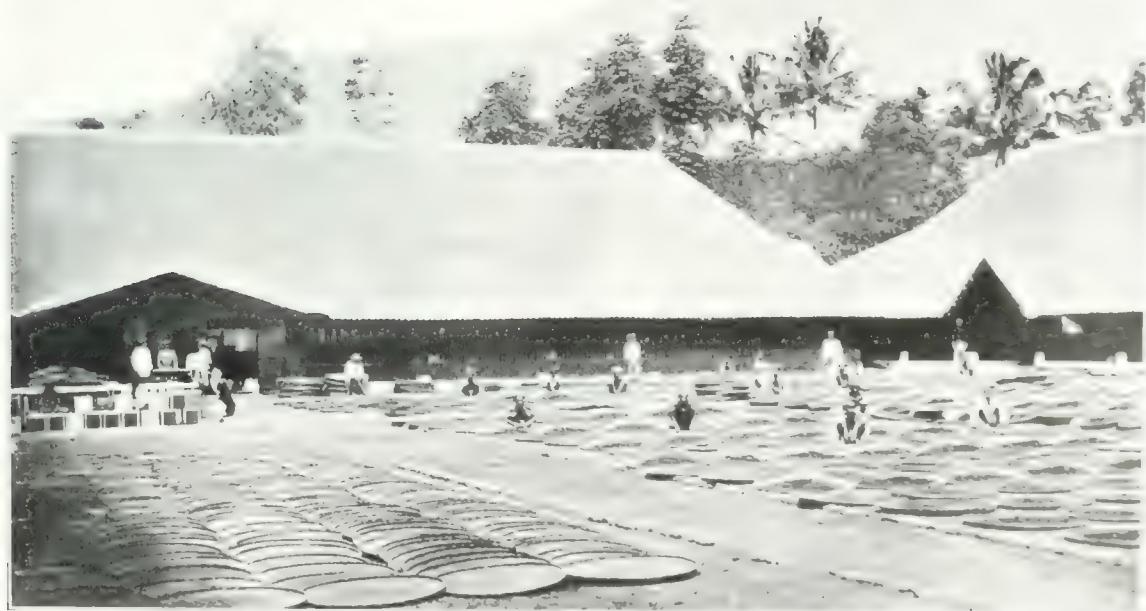
As mentioned above, the very same leaves of the same shrub may produce green-, as well as black tea. The first and second plucking after every lopping are most favourable to the former sort of tea, especially during the rain-season. For the rest the colour depends on the preparation.

§ 7. To make green tea (which is rarely done) in Java the freshly-plucked leaves must be manipulated at once; i. e.: roasted in well-warmed stoves; in this way the fermentation or oxydation is prevented, which is necessary for the preparation of black tea and which is produced by dispersing the fresh leaves and making them fade. The leaves then assume a velvet-like aspect and on pressing a small quantity in the hand they become somewhat like glutin. Then they are ground and rolled incessantly for some time.

The grinding and the rolling is almost always done by machinery, mostly by the „Excelsior” or the „Rapid” machine of Jackson and others, consisting principally of



Manufacture of coal-tar products



two polished wheels, horizontally placed at some distance the one from the other, each having an opposed rotatory movement and so rolling the tea between them. After having been rolled for 10 or 12 minutes, the tea is put on small tanks to get its colour, to oxidate and to ferment by the influence of the air. These tanks are a kind of cube made of interlaced bamboos; they are provided with little feet so that a quantity of them may be placed one upon the other without preventing the air from penetrating.

When the tea is of the required colour, it is conveyed to the drying-shed, where it is dried in warmed air or roasted in stoves.

§ 8. About fifteen years ago only China-tea was planted in the isle of Java. Little by little this custom altered and the China tea gave way for the Assam-tea and the different hybrids between Assam- and China-tea. Now-a-days these sorts predominate and will entirely replace the China tea, as they are much stronger.

In wild condition the Assam plant becomes a tree with a trunk of from 15 to 20 feet thick, whilst the China-tea shrub remains small and only reaches a height of from 6 to 7 feet. In cultivated condition the former plant reaches a height of from 3 to 5 feet, but develops in table-form with a diameter of 4 to 10 feet, the latter reaching no more than 2 or 3 feet. The leaves of Assam-tea grow to a length of 9—15 cM., those of China-tea at most to 4 cM.

Besides, the production of leaves of Assam-tea is more abundant than of China tea.

§ 9. The production of tea in the isle of Java was

1895	4746588	K ^{os.}
1896	3916389	"
1897	4205575	"
1898	4757166	"
1899	5452773	"
1900	6636571	"
1901	7086301	"
1902	7523442	"
1903	10725327	"
1904	10487037	"
1905	10228628	"
1906	11961709	"
1907	11494665	"

Indigo.

§ 1. The kinds of indigo, generally cultivated in the isle of Java, are the Guatemala, originating from Central America, and the Natal. Indigo is a shrub with reddish flowers and oval leaves, the latter containing the colouring matter that is extracted from them by means of fermentation.

The indigo-shrub is cultivated in plains, on light, mixed grounds, which must have been deeply trenched three or four times; as a rule, on plots that may be irrigated (rice-fields) and it is propagated by sowing or (seldom, however) by shoots.

§ 2. In May and June the seed is planted in beds, having a light roof to protect the small plants against the great sun-warmth; during the first few days they must be watered. Often the seed is covered with straw, that is removed after 3 or 5 days.

After a month the seeds are fit to be planted in the soil.

§ 3. Generally, the plants are transplanted in the

prepared soil in the months of May, June or July and planted 1 to 2 feet apart, they are then about 20 cM. high. They are planted in irrigated soil, if possible.

It also happens that the indigo is sown directly in the prepared ground.

§ 4. During the first few weeks after the planting nothing is done but to substitute the languishing and dying plants by fresh plants, then the soil must be turned over and weeded from time to time until the plants have quite matured, which is after about 5 to 6 months; they are then about 3 or $3\frac{1}{2}$ feet. The blossoming is the sign of maturity.

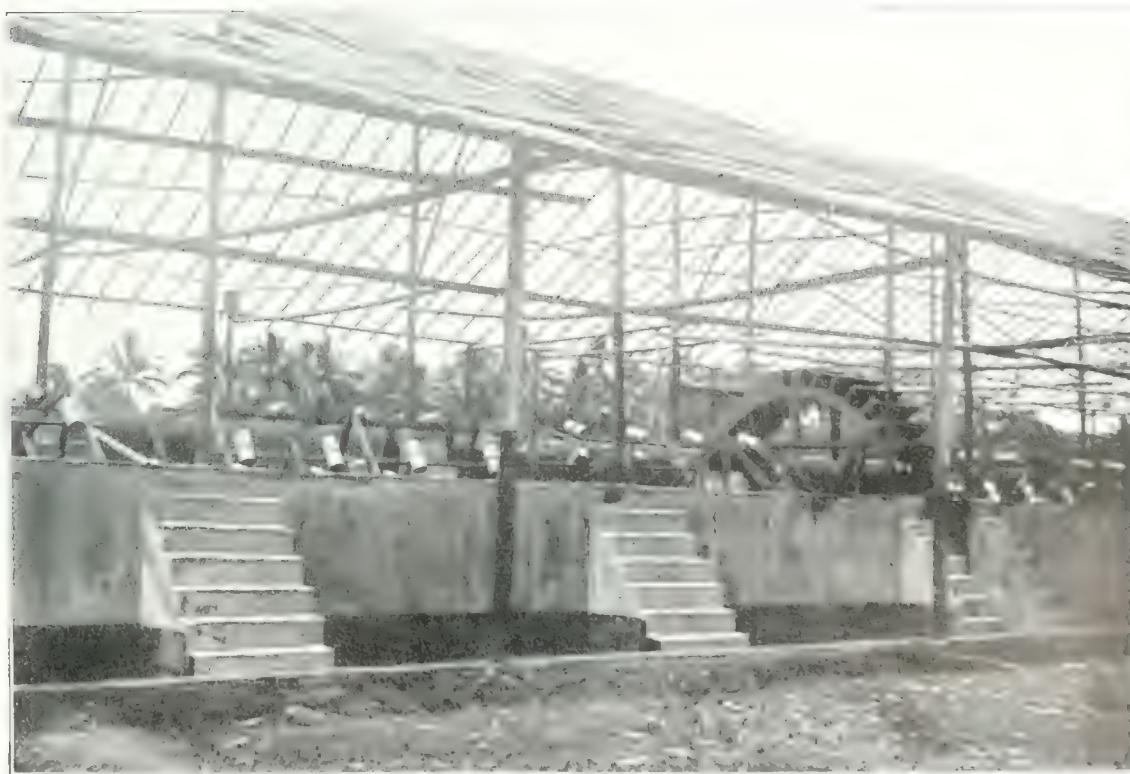
The plants are also covered with clods of earth.

§ 5. This is the moment for the first crop which, three months later, is followed by the second harvest, generally the largest. Three and sometimes four times the cutting may be done. The cut-off leaves (or shoots) are tied in bundles on the field and immediately transported to the manufactory where, as much as possible in standing position, the bundles are placed in fermentation-basins, covering them with an horizontal layer of indigo-plants of from 6 to 12 cM. thickness.

Next, the basins are filled with water to about 6 cM. above the plants, these being kept immerged by hurdles formed of laths of bamboo 1 centimetre apart; these hurdles are pressed down by beams. The process of fermentation soon commences and lasts from 4 to 5 hours,



Sands of the Tenui River.



Pots in which the indigo precipitates are placed, and which are turned by turning wheels provided with zinc pails till the indigo precipitates.

according to the temperature and the nature of the plants. It is always difficult to fix the exact moment at which the fermentation-process is completely finished: a long experience alone teaches this.

After the fermentation, the water, which must smell like beer and be coloured yellowish green, is allowed to run away from the fermentation-basin into another basin placed below, where it is at once set in motion by a wheel provided with zinc pails. The turning movement of the wheel causes the water every time to be taken up by the pails and to be ejected again from a certain height. In this way 240 litres of water come into contact with the oxygen of the atmosphere and gradually the colour changes from yellowish-green into green or dark-green and the indigoprecipitates.

The turning of the wheel is stopped as soon as the grains of indigo are distinctly noticeable and separate themselves from the water. Then all must be allowed to clarify, which takes 2 or 3 hours: after that the water is poured off and the paste resulting therefrom is collected in filtering-basins from which the water oozes, this process lasting 5 to 6 hours. The paste is now taken off the filtering-cloth and put in casks, which are conveyed to the kitchen where the paste is mixed with a certain quantity of water and then boiled, at the same time being stirred continually so as to avoid its burning.

When well boiled, the matter is poured on a filter-

ing-cloth where it is left until the following day. Then the substance is put under the press (a kind of case, in the sides of which holes are made covered with linen) in order to extract all the water that it might yet contain.

The indigo is now cut in tablets which are laid on long wooden benches for 25 days in order to dry.

The last manipulation the tablets have to undergo before being ready for sale is their polishing after leaving the mould. By this means they become of a brilliant purple colour.¹⁾

§ 6. The production of indigo in the isle of Java was as follows, viz:

1895	600911	K ⁹⁸ .
1896	616673	"
1897	779738	"
1898	852663	"
1899	658301	"
1900	614347	"
1901	613018	"
1902	601884	"
1903	721756	"
1904	522063	"
1905	331222	"
1906	289900	"
1907	144086	"

1) For the Natal indigo some manufacturers work with warm water; they than use whitewash, the excess of which they remove by acidified water.

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